

Appl. No. : 09/997,396
Filed : November 28, 2001

REMARKS

Claims 1-53 are pending in the present application. Claims 33-45 and 51 have been withdrawn from consideration. Claims 1-32, 46-50, 52 and 53 stand rejected as being anticipated by Gates et al. (U.S. Patent No. 6,203,613). Claims 1, 14, 15, 20, and 52 have been amended herein to clarify that in the claimed methods the recited metal oxide is deposited by multiple ALD cycles. After the multiple ALD cycles, the deposited thin film of metal oxide is reduced to an elemental metal. Support for these amendments may be found, for example, at paragraph [0014] of the specification.

In addition, several claims have been amended to clarify the nature of the recited metal oxides. Claim 14 has been amended to clarify that the deposited metal oxide layer comprises a magnetic metal. Claim 20 has been amended to clarify that at least one of the metal oxide and elemental metal layers is magnetic. Finally, Claims 25 and 26 have been amended to clarify that the recited first and second metal oxide layers either comprise a magnetic metal or are magnetic oxides. Applicants note that the magnetic oxides may themselves comprise a magnetic metal and that the claim language is not intended to exclude this possibility. These clarifying amendments do not add new matter.

Initially, Applicants would like to point out that the present application is not solely directed to depositing metal oxides through multiple ALD cycles, nor is it simply based on the finding that multiple monolayers of metal oxide deposited by ALD, can subsequently be reduced to elemental metal. Rather, Applicants have found that for the materials at issue and the context at issue, it is advantageous to deposit a material as a metal oxide to obtain a clean deposited layer prior to reduction. This is in contrast to equivalent ALD processes that directly deposit a metal by reducing in each ALD cycle, such as in Gates et al. which are often found to be “dirty” processes that produced highly contaminated metal films.

In addition, Applicants note that several publications related to the reduction of metal oxides deposited by ALD, including U.S. Patent Nos. 6,878,628 and 6,482,740, and U.S. Publication 20040038529, may be available as prior art under 35 U.S.C. §102(e). However, each of these applications and the present application were subject to common assignment at the time of the invention and all are co-owned.

Claim Rejections Under 35 U.S.C. § 102

Claims 1-32, 46-50 and 52-53 stand rejected under 35 U.S.C. § 102(e) as anticipated by Gates. With respect to independent Claim 1, the Examiner found that in Example 8, Gates discloses depositing a first ferromagnetic layer, a dielectric layer and a second ferromagnetic layer by atomic layer deposition. Further, the Examiner states that “the precursors $M(NO_3)_x$ was [sic] formed by ALD and subsequently using hydrogen reduction [sic] to selectively deposit multilayer metal films onto substrates.”

Claim 1 has been amended to recite depositing at least one of the first or second ferromagnetic layers by depositing a metal oxide by multiple ALD cycles and subsequently reducing the metal oxide to elemental metal. In contrast, in the Gates reference, metals are deposited by contacting a substrate with a metal nitrate precursor and reducing the metal nitrate to elemental metal in each ALD cycle. Gates does not teach or suggest depositing a metal oxide by multiple ALD cycles, to say nothing of forming a metal oxide by multiple cycles and then reducing the metal oxide to elemental metal as claimed. As a result, Applicants submit that the rejection of Claim 1 should be withdrawn as well as the rejection of Claims 2-13 which depend from Claim 1 and include all the features thereof in addition to further distinguishing features.

Similarly, with regard to Claim 14, the Examiner found that Gates teaches depositing a magnetic metal oxide layer over a dielectric layer by atomic layer deposition and reducing the magnetic metal oxide layer to a magnetic elemental metal layer. The Examiner refers to Col. 11, lines 55-65 and Col. 4, lines 40-51 for this teaching. Again, Applicants submit that Gates teaches reducing a metal nitrate precursor in every ALD cycle. That is, Gates does not teach or suggest depositing a magnetic metal oxide layer over the dielectric by multiple atomic layer deposition cycles. Rather, in each ALD cycle, Gates reduces any metal oxide precursor to metal. Thus, Gates does not teach or suggest depositing a metal oxide layer by multiple atomic layer deposition cycles at all, much less deposition followed by reducing the metal oxide layer to a magnetic elemental layer as recited in Claim 14.

Claim 15 has also been amended to clarify that the second nonmagnetic metal oxide layer is deposited by multiple ALD deposition cycles prior to being converted to a second nonmagnetic metal layer. Again, Gates only teaches reduction of a metal nitrate precursor in each ALD cycle and does not teach or suggest depositing a metal oxide layer by multiple atomic layer deposition

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cycles, much less subsequently converting such a metal oxide layer to a metal layer. Thus, Applicants submit that the rejection of Claims 14 and 15 should be withdrawn, along with the rejection of Claims 16-19 which depend from Claim 15.

With respect to Claim 20, the Examiner found that Gates discloses a method of fabricating a magnetic structure comprising depositing a plurality of metal oxide layers by ALD and converting at least one of the metal oxide layers to elemental metal. The Examiner refers in particular to Example 8, Col. 11, lines 24-65. As amended herein, Claim 20 recites depositing a plurality of metal oxide layers on a substrate by multiple atomic layer deposition cycles and subsequently converting at least one of the plurality of metal oxide layers to an elemental metal layer. As discussed above, Gates has no teaching or suggestion in Example 8 or anywhere else of depositing metal oxide layers by multiple ALD cycles and subsequently converting the metal oxide layers to elemental layers. As a result, Applicants submit that the rejection of Claim 20 and Claims 21-32, which depend from Claim 20, should be withdrawn.

With respect to Claim 46, the Examiner asserts that as used in Gates, the term “metal-containing films” includes metal oxide, metal nitrides, elemental or any combination or mixture thereof, including multilayers and multicomponent films. The Examiner concludes that Claim 46 is therefore inherent in the product and process of Gates et al. For a prior art reference to anticipate a claim, each and every element of the claim must be present in a single reference and the elements must be arranged as they are in the claim. *In re Bond*, 910 F. 2d 8931, 15 USPQ.2d 1566, 1567 (Fed. Cir. 1990). Applicants respectfully submit that the recitation of “any combination or mixture thereof including multilayer and multicomponent films” does not teach or suggest any particular structure, much less the particular method of fabricating a sensing element of a read-head as claimed. In particular, Gates has no teaching or suggestion of providing a substrate on which the sensing element is to be formed, depositing a first ferromagnetic layer by ALD, depositing a conductive layer over the first ferromagnetic layer and depositing a second ferromagnetic layer over the conductive layer. As neither the method nor a structure that would be produced by such method are taught or suggested anywhere in Gates, Applicants submit that the rejection of Claims 46-51 should be withdrawn.

Finally, with respect to Claim 52, the Examiner again found that Gates teaches or suggests in Example 8 depositing a ferromagnetic metal oxide layer over a dielectric layer by

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ALD and reducing the magnetic metal oxide layer to magnetic element metal layer. Claim 52 has also been amended to clarify that depositing at least one of the first or second ferromagnetic layers comprises depositing a metal oxide by multiple ALD cycles and subsequently reducing the metal oxide to elemental metal. Once more, Applicants submit that Gates et al. only teaches reducing a metal nitrate precursor in each ALD cycle. There is no teaching or suggestion of depositing a metal oxide by multiple ALD cycles and subsequently reducing the metal oxide to elemental metal. Thus, the rejection of Claims 52 and 53, which depends therefrom, should be withdrawn.

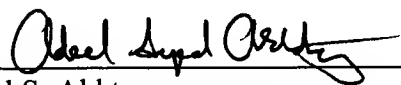
CONCLUSION

In view of the amendments and arguments presented above, Applicants submit that the present application is in condition for allowance and respectfully requests the same. If any issues remain, the Examiner is invited to telephone Applicants' representative at the number provided below in order to resolve such issues promptly.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: April 20, 2005

By: 
Adeel S. Akhtar
Registration No. 41,394
Attorney of Record
Customer No. 20,995
(415) 954-4114

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